ending into a capillary. The wide end was sealed, and a dilatometric fluid such as oil introduced. The conclusions arrived at are that tin, soft solder, and probably also lead, expand on melting; but bismuth contracts. Many observations were made on alloys of bismuth and lead.—On the liquefaction of oxygen, nitrogen, and carbonic oxide, by S. von Wroblewski and C. Olszewski. Intense cold was obtained by evaporation, under reduced pressure, of liquefied ethylene in an apparatus modified from that of Cailletet. Temperatures were measured by a hydrogen pressure-thermometer. Oxygen proved to be liquefiable at temperatures varying from $-129°{\cdot}6$ to $-135°{\cdot}8$ C., under pressures varying from 27·02 to 22·2 atmospheres. The liquefaction of nitrogen and of carbonic oxide proved more difficult, and was not accomplished at a temperature of $-136°$ C., even under a pressure of 150 atmospheres, though a sudden release of pressure produced a temporary mist of condensed spherules, and a slower release of pressure yielded a deposit of liquid with a distinct meniscus. Liquefied nitrogen and liquefied carbonic oxide are both colourless and transparent.—On the internal friction of certain solutions, and on the viscosity of water at different temperatures, by K. F. Slotte. The results confirm those previously obtained by Rosencrantz and Poiseulle. —On a lecture apparatus for demonstrating Poiseulle's law, by W. C. Röntgen.—On the deduction of the crystal systems from the theory of elasticity, by H. Aron; a mathematical discussion of the possible cases arising from the position of planes of symmetry, proving that no others than the recognised six systems of crystals can exist.—On the properties of benzine as an insulator and as a substance exhibiting electric reaction, by H. Hertz. *Pure* benzine appears to be remarkably good as an insulator and remarkably free from reaction effects.—On the influence of galvanic polarisation on friction, by K. Waitz. Treats of the phenomenon discovered by Edison, and recently examined by K. R. Koch.—On the properties of calc-spar in the homogeneous magnetic field, by Fr. Stenger.—Notes on a photometric apparatus, by Leonhard Weber.—On "the Exhibition of the Treatise on Light" of Ibn al Haitam, by E. Wiedemann.—On the Cologne air-pump of the year 1641, a historical notice by Dr. G. Berthold.—Remarks on the memoir of Herr Christiansen, "Researches on Heat-Conductivity," by A. Winkelmann.

Atti of the Royal Academy dei Lincei, July 12-15, 1883.—Obituary notice of William Spottiswoode.—Two communications from Signor Tacchini on the observations made by him at Caroline Island during the solar eclipse of May 6, 1883.—On the average variation in tension of the atmospheric aqueous vapour according to latitude and elevation in Italy, by A. Lugli. —Meteorological observations at the Royal Observatory of the Campidoglio for the months of June and July.—Most of the present number is occupied with the new reforms and statutes of the Academy, whose constitution has recently been remodelled. There are also long inventories of the works of art, furniture, and fixtures of the Palazzo Corsini, which has been purchased as the future home of the Academy.

Rivista Scientifico Industriale, Florence, September 15-30.—The total eclipse of May 6. Results of the observations of Tacchini, Janssen, and others, in Caroline Island.—Eclipses and terrestrial magnetism, by P. Denza. All connection is denied between eclipses and magnetic phenomena.—On the compressibility of water, by S. Pagliani and G. Vicentini.—A new electrodynamometer, by Prof. Bellati.—On the deformation detected by Gouy in polarised electrodes, by A. Volta.—An improved reversible magnetico-electric machine, by M. Delaurier.—Anatomical description of two extremely rare birds (*Somateria mollissima* and *Phalaropus fulicarius*) preserved in the Civic Museum of Venice, by P. A. Ninni.—On the fossil vertebrates of the Miocene formations in the Venetian Alps, by Baron Achille de Zigno.—On the fossil gastropods, cephalopods, and corals of the lower titonic formations of Sicily, by Dr. G. de Stefano.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, November 15.—Dr. Perkin, F.R.S., president, in the chair.—It was announced that a ballot would take place at the next meeting (Dec. 6).—The following papers were read:—On the estimation of starch, by C. O'Sullivan. The method may be briefly described as follows:—About five grms. of the finely ground grain are successively extracted with ether, alcohol (sp. gr. 0·90), and water at 35° to 38°. Fat, sugar, albuminoids, amylams, &c., are thus got rid of. The starch in the washed residue is gelatinised by boiling with water, cooled to 62°, about 0·03 grm. diatase (prepared by precipitating a cold, aqueous extract of malt with alcohol) added; the starch is thus converted entirely into maltose and dextrin, and by a quantitative determination of these two products the starch originally present can be calculated. The author states, as the result of his experience with the method, that the difference in results obtained by any two observers need not exceed 0·5 per cent. of the total starch.—On the illuminating power of ethylene when burnt with non-luminous combustible gases, by P. F. Frankland. The author summarises his results as follows:—Pure ethylene burnt at the rate of five cubic feet per hour from a Referees Argand burner, emits a light of 68·5 standard candles; the illuminating power of equal volumes of mixtures of ethylene with either hydrogen, carbon monoxide, or marsh gas is less than that of pure ethylene; when such mixtures contain 60 per cent. of ethylene or more, the illuminating power of the mixture is but slightly affected by the nature of the diluent; in mixtures containing less than 60 per cent. of ethylene, the illuminating power is the highest when marsh gas, and lowest when carbon monoxide, is the diluent.—On the products of decomposition of aqueous solutions of ammonium nitrite, by G. S. Johnson. The nitrogen evolved from alkaline solutions of ammonium nitrite contains no oxides of nitrogen; nitrogen is evolved from aqueous solutions below 100°; by adding crystallised cupric chloride, a continuous evolution of pure nitrogen takes place in the cold. When solutions are acid, the nitrogen may contain 4 per cent. of nitric oxide. About 2 per cent. of the nitrogen evolved by the cupric chloride is stated by the author to possess peculiarly active properties, and forms ammonia when passed with hydrogen over spongy platinum.—On the estimation of iron by standard potassium bichromate, by E. B. Schmidt. The author recommends the above process, but states that zinc should not be used to reduce the iron, as it interferes with the end reaction with potassium ferricyanide. He prefers Kessler's method of reduction with stannous chloride.

Western Microscopical Club, November 5.—Mr. W. Crookes gave a lecture on "Recent Discoveries in High Vacua." He illustrated his theme with a series of brilliant and interesting experiments. The effects were produced by a large electric coil, having sixty miles of secondary wire, and worked by two cells of a storage-battery. The coil, when attached to its full complement of thirty cells, would give a spark in air of twenty-four inches. "High vacua" were defined as those ranging from above the 1/1000 to the 1/100,000,000 of an atmosphere. Air and all gases are conceived to consist of myriads of excessively minute molecules, which in the ordinary state vibrate with enormous velocity; but being crowded together in that condition their extent of vibration is impeded by each other, and is, in fact, limited to a path of only 1/10,000 of a millimetre. When, as in a partial vacuum, there are fewer of these molecules, they have more room in which to vibrate, and hence their "mean length of path" is increased. Under the influence of electricity these molecules are driven in straight lines from the negative pole. In a comparatively low vacuum, on the passage of an electric current, the residual air assumes a stratified condition, showing alternate light and dark bands. The width of the dark bands marks the length of the excursions of the molecules. Further exhaustion increases the width of these bands, so that in a vacuum of 1/1,000,000 of an atmosphere the free path of the molecules was seen to extend to about four inches. By means of an exhausted V-shaped tube it was shown that these molecules are driven from the negative pole in straight lines, and hence cannot turn a corner. First one limb of the V, then the other, was connected with the negative pole of the coil, with the result that each in turn was in darkness. In another vacuum-tube a concave negative pole was fixed; the molecules were driven normally from this concave surface, and, meeting the cylindrical surface of the glass inclosure, were thrown into beautiful caustic curves. That these molecules, under the influence of electricity, possessed mechanical force was shown by causing them to impinge on the vanes of a radiometer, when a rapid rotation took place. On reversing the current, the direction of rotation was also reversed. That this was not due merely to the passage of an electric current was shown by a vacuum-tube containing a small, horizontal "water-wheel." Its upper and lower floats being struck equally by the radiant matter, no motion took place; but

on diverting the flow of radiant molecules by means of the external application of a magnet, the molecules were caused to strike the upper floats only, when revolution took place. By reversing the magnet, the path of the molecules was diverted so as to strike the lower floats, and thus to reverse the rotation. Radiant molecules are not attracted by one pole of a magnet and repelled by the other, but tend to rotate round the north pole in one direction and round the south pole in the opposite direction. Hence, with a horseshoe magnet, they are deflected in a line at right angles to the line that joins the two poles. The mechanical effect of the impact of these radiant molecules was further shown by converging them by means of a concave negative pole to a focus in which was a small bundle of platinum wires. These wires were rapidly raised to a white heat by the vigorous though inaudible bombardment. Further, the impact of radiant molecules on certain bodies produces phosphorescent light; thus they give to potash-glass a green and to lead-glass a blue tinge. If in an exhausted tube an obstacle, such as a piece of mica in the shape of a cross, be set up, a dark shadow of it is thrown on the positive end of the tube, the part surrounding the shadow being rendered phosphorescent by the impact of the molecules. On suddenly removing the obstacle, the part that was in shadow glows brighter than in surrounding luminous space. This effect is due to the molecules acting suddenly on a new and, as it were, untired surface.

CAMBRIDGE

Philosophical Society, October 29.—The following officers for the ensuing year were elected:—President, Mr. Glaisher; Vice-Presidents: Prof. Cayley, Prof. Stokes, Lord Rayleigh; Treasurer, Mr. J. W. Clark; Secretaries: Mr. Trotter, Mr. Glazebrook, Mr. Vines; New Members of Council: Prof Humphry, Prof. Babington, Prof. Adams, Prof. Newton, Mr. F. Darwin, Mr. Shaw, Mr. Sedgwick.—The following papers were communicated to the Society:—On the effect of viscosity upon the tides, by Rev. Osmond Fisher.—Note on Mr. Larmor's communication on "Critical Equilibrium," by Mr. Greenhill.—On some general equations which include the equations of hydrodynamics, by Mr. M. J. M. Hill.

EDINBURGH

Mathematical Society, November 9.—Mr. J. S. Mackay, F.R.S.L., in the chair.—The opening address of the session was delivered by Prof. Tait, who chose for his subject "Listing's Topologie."—The office-bearers elected were:—President, Thomas Muir, F.R.S.E.; Vice-President, A. J. G. Barclay; Secretary and Treasurer, A. Y. Fraser; Committee: R. E. Allardice, William Peddie, Robert Robertson, David Traill, B.Sc.

PARIS

Academy of Sciences, November 12.—M. Blanchard, president, in the chair.—On the velocities acquired in the interior of a vessel by the diverse elements of a fluid during its discharge through a lower orifice, and on the simple means possible to be employed in determining very approximately the numerical residuums of slightly converging double series, by MM. de Saint-Venant and Flamant.—Extract from a letter addressed to M. Daubrée by M. Nordenskjöld on the results of his recent expedition to Greenland.—On a tribasic oxalate of alumina, by M. Mathieu-Plessy.—Note on the letter communicated to the Academy by M. Martial, Captain of the *Romanche*, on his return from Tierra del Fuego and neighbouring waters, by M. Alph. Milne-Edwards. Soundings and dredgings were taken at depths of 600 metres; a careful study was made of the fauna and flora on the mainland, as well as of the Fuegian aborigines, and 167 cases of collections were brought back, including two skeletons of whales, and several living specimens of animals and plants. On his return M. Martial determined the presence of a deep trough about the twentieth meridian south of the equator, 7370 metres deep, near the ridge of submarine banks discovered by the *Challenger* and *Gazelle*.—Observations on the Pons-Brooks comet made at the Observatory of Nice (Gautier-Eichens equatorial), and comparison with MM. Schulhof and Bossert's ephemerides, by M. Perrotin.—On certain astronomical formulas of Hansen and Tisserand, by M. P. Appell.—On the asymptotic lines of wave surfaces, by M. G. Darboux.—On the functions of two independent variables rendered invariable by the substitutions of a discontinued group, by M. E. Picard.—Note on the nature of an algebraic relation between two uniform functions of an analytical point (x, y), by M. E. Goursat.—On an algebraic problem in the theory of elimination, by M. Cyparissos Stéphanos.—A description of the differential pyrometer patented in February, 1882, by M. E. H. Amagat.—On an optical photometer, by M. L. Simonoff.—On the measurement of electromotor forces (two illustrations), by M. E. Reynier.—On an electric sounding apparatus for great depths (four illustrations), by M. E. de la Croix.—On a rapid method for determining the work absorbed or produced by a dynamo-electric machine, by M. Pierre Picard.—On a new series of combinations of titanium, by M. A. Piccini.—Qualitative research and quantitative analysis of zinc and lead in iron ores, by M. A. Deros.—On the formation of considerable quantities of alcohol in the fermentation of bread stuffs, by M. V. Marcano.—Determination of the causes tending to diminish the susceptibility of certain regions of the organism to the virus of bacterian or symptomatic charbon, transforming a fatal into a prophylactic inoculation, by MM. Arloing, Cornevin, and Thomas.—On the source of the imperfectly-oxydised sulphur present in urine, by MM. R. Lépine and G. Guérin.—On the development of the branchia of cephalopods, by M. L. Joubin.—On the functions of the renal sac in heteropods, by M. L. Joliet.—Remarks on the *Crocodilus robustus*, Vaill. and Grand., of Madagascar, by M. L. Vaillant.—On the osmotic force of diluted solutions, by M. Hugo de Vries.—On the interpretation of an experiment by Hales touching the function of vegetable vessels, by M. J. Vesque.—Note on the direct observation of the movement of water in plants, by M. G. Capus.—Remarks on the saccharoid and serpentine limestones of the northern slopes of the Pyrenees, by M. Dieulafait.—On the causes of abnormal winters (five illustrations), by M. L. Teisserenc de Bort.—The election was reported of M. Charcot in place of M. Cloquet in the Section of Medicine and Surgery.

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